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PATENT APPLICATION

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TITLE: PRESENTATION SERVICE ARCHITECTURES
                                FOR NETCENTRIC COMPUTING SYSTEMS

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PRESENTATION SERVICE ARCHITECTURES FOR
NETCENTRIC COMPUTING SYSTEMS

This application claims the benefit under 35 U.S.C. §119(e) of U.S. provisional
5   application Serial No: 60/156,962 filed on October 1, 1999.

Field of the Invention

The present invention relates generally to computing systems, and more particularly
to presentation service architectures for netcentric computing systems.

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Background of the Invention

Computer based business solutions have existed for various different types of
transactions since the mid-to-late 1960s. During this time period, the technology focused
on the use of batch technology. In batch processing, the business user would present a file
15   of transactions to the application. The computer system would then run through the
transactions, processing each one, essentially without user intervention. The system would
provide reporting at some point in the batch processing. Typically, the reports would be
batch printed, which in turn, would be used by the business user to correct the input
transactions that were resubmitted along with the next batch of transactions.

20   In the 1970s, businesses began a transition to on-line, interactive transactions. At a
conceptual level, this processing opened up the file of transactions found in batch
transactions and allowed the user to submit them one at a time, receiving either immediate
confirmation of the success of the transaction or else feedback on the nature of the
transaction error. The conceptually simple change of having the user interact with the
25   computer on a transaction-at-a-time basis caused huge changes in the nature of business
computing. More important, users saw huge changes in what they could do on a day-to-
day basis. Customers were no longer forced to wait for a batch run to process the
particular application. In essence, the computer had an impact on the entire work flow of
the business user.

30   Along with the advent of on-line interactive systems, it was equally significant that
the systems provided a means for the business user to communicate with others in the
business as the day-to-day business went along. This capability was provided on the
backbone of a wide area network (WAN). The WAN was in itself a demanding technology

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during this time period and because of these demands telecommunications groups emerged within organizations, charged with the responsibility to maintain, evolve, and manage the network over a period of time.

The theme of the 1980s was database management systems (DBMSs).

5 Organizations used and applied database technology in the 1970s, but in the 1980s they grew more confident in the application of DBMS technology. Because of the advances in network technology, the focus was now on the sharing of data across organizational and application boundaries. Curiously, database technology did not change the fundamental way in which business processing was done. DBMS made it more convenient to access the

10 data and to ensure that it could be updated while maintaining the integrity of the data.

In the 1990s, technology began to shift toward client/server computing. Client/server computing is a style of computing involving multiple processors, one of which is typically a workstation, and across which a single business transaction is completed. Using the workstation, the transaction entered by the user could now be processed on a

15 keystroke-by-keystroke basis.

Furthermore, there was a change in the communications. With client/server, users could communicate with others in the work group via a local area network (LAN). The LAN permitted workstation-to-workstation communications at speeds of 100 to 1,000 times what was typically available on a WAN. The LAN was a technology that could be grown

20 and evolved in a local office with little need for direct interaction from the telecommunications group.

During the late 1990s, the Internet began to receive widespread use by consumers and businesses. In the business world, the Internet has caused the concept of business users to expand greatly because of the way in which computers are now capable of being

25 interconnected. In addition, the cost of computers has dropped to the point that it is affordable for almost every household to own a computer if they so desire. As such, a need to expand the reach of computing both within and outside the enterprise, and that enables the sharing of data and content between individuals and applications has developed.

30 **Summary of the Invention**

One aspect of the present invention discloses a presentation service architecture for a netcentric computing system. In the preferred embodiment of the present invention, the

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presentation service architecture includes a web server that is connected with a client. The presentation service architecture includes desktop manager services, direct manipulation services, form services, input device services, report and print services, user navigation services, web browser services and windows system services. These services are

5   preferentially located on the client and interact with the web server to generate and pass information to and from the web server and/or client during operation.

The desktop manager service is provided to allows users to manipulate files and launch applications that are located on the client. The direct manipulation service allows users to manage at least one software application object by manipulating visual

10   representations of the application objects located on the client. The form service enables applications from the web server to use at least one field to display and collect data from the client.

In the preferred embodiment of the present invention, the presentation service architecture includes input device services for detecting user inputs from at least one input

15   device located on the client. The report and print service enables on-screen previewing and printing of documents that contain data that are generated on the client by the web server. The user navigation service provides users with the ability to access or navigate between functions within or across applications that are generated on the client by the web server. The web browser service allows users to view and interact with applications and documents

20   also located on the client. The window system service for providing a base functionality for creating and managing a graphical user interface is also located on the client.

In a netcentric computing system, an effective presentation service architecture controls how users interact with the web server and thereby the netcentric computing system. The services that the presentation service architecture perform include capturing

25   user actions, generating events, presenting data to the user and assisting in the management of the window flow. During operation, the preferential presentation service architecture includes services that are capable of providing applications that satisfy the needs of the user that is using a client that may be located hundreds of miles away. The web browser services provide this interaction by allowing the client and the web server to interact and

30   pass information to and from each other.

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Further objects and advantages of the present invention will be apparent from the following description, reference being made to the accompanying drawings wherein preferred embodiments of the present invention are clearly shown.

5 Brief Description of the Drawings

Figure 1 illustrates a preferred presentation service architecture for a netcentric computing system.

Figure 2 illustrates a representative netcentric computing system.

10 Detailed Description of the Preferred Embodiments of the Present Invention

Referring to Figs. 1 and 2, the present invention discloses a presentation service architecture 10 for a netcentric computing system 12 that includes at least one client 14 connected with at least one web server 16. Referring to Fig. 2, the physical picture of an illustrative example of a netcentric computing system 12 is illustrated. A business

15 enterprise 18 may include at least one client 20, at least one database server 22, at least one firewall 24, at least one application server 26, at least one web server 28 and a LAN connection 30, connected as illustrated in Fig. 2. The LAN connection 30 is used to interconnect various components or computing devices that are located at a first enterprise location 32 within the business enterprise 18. Those skilled in the art would recognize that

20 various types of LAN connections 30 exist and may be used in the present invention.

For the purpose of the present invention, the firewall 24 is used to isolate internal systems from unwanted intruders. As known in the art, firewalls 24 isolate the web servers 28 from all Internet traffic that is not relevant to the netcentric computing system 12. In the preferred embodiment, the only requests allowed through the firewall 24 are for services on

25 the web servers 28. All requests for other applications (e.g., FTP, Telnet) and other IP addresses are blocked by the firewall 24.

The web servers 28 are the primary interface to the clients 14, 20 for all interactions with the applications or services of the netcentric computing system 12. The main task of the web servers 28 is to authenticate the clients 14, 20, establish a secure connection from

30 the clients 14, 20 to the web servers 28 using encrypted messages, and allow the applications the clients 14, 20 are using to transparently access the resources of the netcentric computing system 12. The web servers 28 are responsible for accepting incoming HTTP messages and fulfilling the requests. For dynamic HTML page

generation, requests are forwarded to the application servers 26. Static pages, such as help pages, are preferably generated by the web servers 28.

In the preferred embodiment, the primary function of the application servers 26 is to provide a link through which the web servers 28 can interact with the clients 14, 20, trigger

5   business transactions, and send back resulting data to the clients 14, 20. A fundamental role of the application servers 26 is to manage the logical flow of the transactions and keep track of the state of the sessions. The application servers 26 are also responsible for managing all sessions.

Further, in the preferred embodiment of the present invention, the main purpose of

10   the database servers 22 is to handle an application log. All requests sent to the web servers 28 and application servers 26 as well as responses are logged in the application log. The application log is preferentially used for traceability. In the preferred embodiment, requests are logged in the application log directly by the application server 26. Those skilled in the art would recognize that any number of data items can be monitored by the application log.

15   As further illustrated in Fig. 2, a second business enterprise location 34 may be connected with the first business enterprise location 32 using a intranet connection 36. Those skilled in the art would recognize that various intranet connections 36 exist and may be used in the present invention. As those skilled in the art would recognize, the intranet connection 36 allows the computing resources of the second business enterprise location 34

20   to be shared or connected with the computing resources available at the first business enterprise location 32. Although not illustrated, several other enterprise locations may be connected with the netcentric computing system 12.

In the preferred embodiment the firewall 24 of the first business enterprise location 32 is connected with a dedicated Internet connection 38 to a plurality of remote clients 14.

25   Preferentially, the remote clients 14 that are connected to the Internet connection 38 access data at the business enterprise 18 through the Internet connection 38 using a browser application. The Internet connection 38 gives the remote clients 14 the ability to gain access to information and data content contained on the database server 22, the application server 26 and the web server 28. For a detailed discussion of the architecture for the

30   preferred netcentric computing system 12, refer to co-pending U.S. patent application Serial Number _____ entitled ARCHITECTURES FOR NETCENTRIC

COMPUTING SYSTEMS, which was filed on September 29, 2000, and is hereby incorporated by reference, in its entirety.

In the preferred embodiment, the presentation service architecture 10 uses various software applications to manage the human-computer interface in the netcentric computing system 12. These software applications capture user actions and generate resulting events, present data to the user, and assist in the management of the dialog flow of processing. Typically, the presentation service architecture 10 is only required by the clients 14, 20 in the netcentric computing system 12. During operation, the applications in the presentation service architecture 10 pass information and interact with the web server 28.

As set forth in Fig. 1, the preferred presentation service architecture 10 consists of software applications that provide desktop manager services 42, direct manipulation services 44, forms services 46, input device services 48, report and print services 50, user navigation services 52, web browser services 54 and window system services 56. The term service, as used in this disclosure, should be construed to include software applications that enable and support certain features of the preferred presentation service architecture 10. Those skilled in the art of programming should recognize that various software applications exist and may be created for use in the preferred embodiment of the present invention.

The desktop manager services 42 provides for implementing the "desktop metaphor," which is commonly used to refer to a style of user interface that emulates a physical desktop. It allows the user to place documents on the desktop, launch applications by clicking on a graphical icon, or discard files by dragging them onto a picture of a wastebasket. The desktop manager service 42 includes facilities and devices for launching applications and desktop utilities and managing their integration. Most windowing systems contain elementary desktop manager functionality (e.g., the Windows 95 and 98 desktop), but often more user-friendly or functional desktop manager services are required. Some representative products that provide desktop manager services include Norton Navigator, Microsoft Windows 95 and 98 Task Bar, Xerox Tabworks and Starfish Software Dashboard.

The direct manipulation services 44 use applications to provide a direct manipulation interface (often called "drag and drop"). A direct manipulation interface allows users to manage multiple application objects by manipulating visual representations of those objects

on the clients 14, 20. For example, a user may sell stock by dragging stock icons out of a portfolio icon and onto a trading floor icon.

The direct manipulation services 44 can be divided into display validation services 58 and input validation services 60. The display validation services 58 enable applications to represent application objects as icons and control the display characteristics (color, location, etc.) of these icons on the clients 14, 20. The input/validation services 60 enable applications to invoke validation or processing logic when an end user "acts on" an application object. "Acting on" an object may include single clicking, double clicking, dragging or sizing. The method of selecting an object may vary from application to application, however, those skilled in the art would recognize that several methods of selecting or acting on an object exist and are envisioned by the present invention.

The form services 46 include applications that use fields to display and collect data. A field may be a traditional 3270-style field used to display or input textual data, or it may be a graphical field such as a check box, a list box, or an image. The form services 46 provide support for display, input-validation, mapping support and field interaction management.

In the preferred embodiment, the form services 46 enables applications to use fields to display and collect data. During operation, the form services 46 provide support for displaying objects by being capable of displaying various data types (e.g., text, numeric, date, etc.) in various formats (e.g., American/European data, double-byte characters, icons, etc.). In addition, the form services 46 enable applications to collect information from the user, edit it according to the display options, and perform basic validation such as range or format checks.

The form services 46 eliminates the need for applications to communicate directly with the window system service 56; rather, applications retrieve or display data by automatically copying the contents of a window's fields to a copybook structure in memory. These services may also be used to automate the merging of application data with predefined electronic form templates. The form services 46 is capable of coordinating activity across fields in a window by managing field interdependencies and invoking application logic based on the state of fields and user actions. For example, a field interaction manager in the form services 46 may disable the "OK" button until all required

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input fields contain valid data. These services significantly reduce the application logic complexity inherent to an interactive windowed interface.

The input device services 48 detect user input from a variety of input technologies, such as pen based, voice recognition and response systems, keyboards, touch-screens, mice, digital cameras, and scanners. Voice response systems are used to provide prompts and responses to users through the use of phones. Voice response systems have scripted call flows, which guide a caller through a series of questions. Based on the user's keypad response, the voice response system can execute simple calculations, make database calls, call a mainframe legacy application, or call out to a custom C routine. Representative voice response system vendors include VoiceTek and Periphonics.

Voice recognition systems are becoming more popular in conjunction with voice response systems. Users are able to speak to the phone in addition to using a keypad. Voice recognition can be an extremely powerful technology in cases where a keypad entry would be limiting (e.g., date/time or location). Sophisticated voice recognition systems have been built that support speaker independence, continuous speech and large vocabularies.

Those skilled in the art would recognize that various input device services 24 exist and may be used with the present invention. These applications within the input device services 48 will need to be tailored to the needs of the particular enterprise using the presentation services architecture 10. As such, those skilled in the art would recognize that the scope of the present invention should not be limited by the illustrative input devices set forth briefly above.

The report and print services 50 support the creation and on-screen previewing of paper or photographic documents, which contain screen data, application data, graphics or images. In order to perform optimally, the report and print services 50 must take into consideration varying print scenarios common in netcentric computing system environments, including varying graphics/file types (Adobe, .PDF, .GIF, .JPEG), page margins and breaks, HTML constructs including tables and frames, headers/titles, extended character set support, etc. Those skilled in the art would recognize that various report and print services 50 may be used in the present invention.

The user navigation services 52 provide a user with a way to access or navigate between functions within or across applications. A common method for allowing a user to

navigate within an application is to list available functions or information by means of a menu bar with associated pull-down menus or context-sensitive pop-up menus. This method conserves screen real estate by hiding functions and options within menus, but for this very reason can be more difficult for first-time or infrequent users. This point is

5   important when implementing electronic commerce solutions where the target customer may use the application only once or very infrequently (e.g., purchasing auto insurance). A text-based menuing system that provides a list of applications or activities for the user to choose from may also be used. Those skilled in the art would recognize that various user navigation services 52 may be incorporated in the present invention as they become

10   available.

The web browser services 54 provide applications that allow users to view and interact with applications and documents made up of varying data types, such as text, graphics and audio that are stored or located on the netcentric computing system 12. As such, in the preferred embodiment the web browser services 30 provide support for

15   navigation within and across documents and files no matter where they are located through the use of links embedded into the document content or the file structure. The web browser services 54 retain the link connection, i.e., document physical location, and mask the complexities of that connection from the user.

As known in the art, much of the appeal of web browsers is the ability to provide a

20   "universal client" that offers users a consistent and familiar user interface from which all types of applications can be executed and all types of documents can be viewed, regardless of the type of operating system or machine as well as independent of where these applications and documents reside. Web browsers employ standard protocols, such as Hypertext Transfer Protocol (HTTP) and File Transfer Protofocol (FTP) to provide

25   seamless access to documents across machine and network boundaries.

Examples of products that provide web browser services include Netscape Navigator. One of the original browsers, Navigator currently has a large share of the installed browser market and strong developer support, and Microsoft Internet Explorer (IE). Leveraging the market strength of Windows, Internet Explorer is tightly integrated

30   with Windows and supports the major features of the Netscape Navigator as well as Microsoft's own ActiveX technologies.

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It should be noted that the distinction between desktop and web browsers may well disappear with the release of products that integrate web browsing into the desktop and give a user the ability to view directories as through they were web pages. Web browser, as a distinct entity, may even fade away with time. As known in the art, browsers require new

5   or at least revised development tools for working with new languages and standards such as HTML and Java. Many browser content development tools have flooded the market recently. The following are several representative products that provide browser services.

Netscape LiveWire and LiveWire Pro – visual tool suite designed for building and managing complex, dynamic Web sites and creating live on-line applications. Symantec

10   Visual Café – the first complete Rapid Application Development (RAD) environment for Java. With Visual Café, one can assemble complete Java applets and applications from a library of standard and third-party objects, without writing source code, for very simple applications. Visual Café also provides an extensive set of text-based development tools. Microsoft FrontPage – provides an integrated development environment for building Web

15   sites, including WebBots, which provide services for implementing common features such as search engines and discussion groups. Microsoft Visual J++ - a product similar to Visual C++, VJ++ allows the construction of Java applications through an integrated graphical development environment.

As illustrated in Fig. 1, the web browser services 54 can be further subdivided into

20   browser extension services 62, web browser form services 64 and web browser user navigation services 66. The browser extension services 62 provide support for executing different types of applications from within the web browser services 54. These applications provide functionality that extends web browser capabilities. The key web browser extensions 62 are plug-ins, helper application/viewers, Java applets, Active/X controls and

25   Java beans.

A plug-in is a software program that is specifically written to be executed within a browser for the purpose of providing additional functionality that is not natively supported by the browser, such as viewing and playing unique data or media types. For example, early browsers did not natively support multimedia data types such as sound. Sound plug-

30   ins were used by the browser to play back the sound component of a document. Other plug-ins allow mainframe 3270-based applications to be viewed directly or mapped into a

more friendly form-style interface. Plug-ins cover everything from streaming video to interactive conferencing, and new ones are being released every week.

Typically, to use a plug-in, a user is required to download and install the plug-in on his/her client machine. Once the plug-in is installed, it is integrated into the web browser on the client machine. The next time the web browser opens a web page that requires that plug-in to view a specific data format, the browser initiates the execution of the plug-in. Special plug-in APIs are used when developing plug-ins. Until recently, plug-ins were only accessible from the Netscape browser. Now, other browsers such as Microsoft's Internet Explorer are beginning to support plug-in technology as well. However, plug-ins written for one browser will generally need to be modified to work with other browsers. Also, plug-ins are operating-system dependent. Therefore, separate versions of a plug-in are required to support Windows, Macintosh and Unix platforms.

Unlike a plug-in, a helper application is not integrated with the web browser, although it is launched from a web browser. A helper application generally runs in its own window, contrary to a plug-in, which is generally integrated into a web page. Like a plug-in, the user installs the helper application. However, because the helper application is not integrated with the browser, the user tends to do more work during installation specifying additional information needed by the browser to launch the helper application.

A java applet is a program written in Java that runs within or is launched from the client's browser. This program is loaded into the client device's memory at run time and then unloaded when the application shuts down. A Java applet can be as simple as an animated object on an HTML page or can be as complex as a complete windows application running within the browser.

A ActiveX control is also a program that can be run within a browser, from an application independent of a browser, or on its own. ActiveX controls are components, developed using Microsoft's standards that define how software components should be built. Although Microsoft is positioning ActiveX controls to be language- and platform-independent, today they are limited to the Intel platforms. Within the context of a browser, ActiveX controls add functionality to Web pages. These controls can be written to add new features such as dynamic charts, animation or audio. Plug-ins and ActiveX controls are functionally similar, but ActiveX controls provide more functionality, such as a self-installing capability.

JavaBeans – JavaSoft's (i.e., Sun's Java development and marketing unit) counterpart to ActiveX controls, based on CORBA standards. JavaBeans can also be anything from small visual controls, such as a button or a date field, to full-fledged applications, such as word processors, spreadsheets, browsers, etc.   Viewers and

5   plug-ins are some of the most dynamic segments of the browser market due to quickly changing technologies and companies.

The following are examples of plug-in execution products that may be used in the preferred presentation services architecture 10: Real Audio – a plug-in designed to play audio in real-time on the Internet without needing to download the entire audio file before

10   you can begin listening. VDOLive – a plug-in designed to view real-time video streams on the Internet without needing to download the entire video file before you can begin viewing; similar in concept to Real Audio. Macromedia Shockwave – a plug-in used to play back complex multimedia documents created using Macromedia Director or other products. Internet Phone – one of several applications that allows two-way voice

15   conversation over the Internet, similar to a telephone call. Information Builder's Web3270 – a plug-in that allows mainframe 3270-based applications to be viewed across the Internet from within a browser. The Web3270 server provides translation services to transform a standard 3270 screen into an HTML-based form. Interest in Web3270 and similar plug-ins has increased with the Internet's ability to provide customers and trading partners direct

20   access to an organization's applications and data. "Screen scraping" viewers can bring legacy applications to the Internet or intranet very quickly.

The web browser form services 64, like the forms services 46 outside of the web browser services 54, enable applications to use fields to display and collect data. The difference between the two services is the technology used to develop the forms that are

25   used by the web browser form services 64. The most common type of web browser form services 64 within the web browser is Hyper-Text Mark-up Language (HTML). Currently, HTML browsers support only the most rudimentary forms, basically providing the presentation and collection of without validation or mapping support. When implementing forms with HTML, additional services may be required such as client side-scripting (e.g.,

30   VB Script of JavaScript).

Microsoft has introduced ActiveX documents that allow forms such as Word documents, Excel spreadsheets, and Visual Basic windows to be viewed directly from

Internet Explorer just like HTML pages. Today, different technologies are used to create forms that are accessible outside of the browser from those that are accessible within the browser. However, with the introduction of ActiveX documents, these differences are getting narrower. Those skilled in the art would recognize that as the web browser services

5   54 expand various other types of web browser form services 64 will be readily incorporated into the present invention.

The web browser user navigation services 66, like the user navigation services 52 outside the web browser services 54, provide users with a way to access or navigate between functions within or across applications located on the web server 28. The

10   preferred web browser user navigation services 66 can be subdivided into three categories: hyperlink, customized menu and virtual reality services.

A hyperlink has popularized the use of underlined key words, icons and pictures that act as links to additional pages. The hyperlink mechanism is not constrained to a menu, but can be used anywhere within a page or document to provide the user with navigation

15   options. It can also take a user to another location within the same document or a different document altogether or even a different server or company for that matter. There are three types of hyperlinks: hypertext, icon and image map.

Hypertext is very similar to the concept of "Context Sensitive Help" in Windows, where the reader can move from one topic to another by selecting a highlighted word or

20   phrase. Icon is similar to the hypertext menu above, but selections are represented as a series of icons. The HTML standard and popular browsers provide hyperlinking services for non-text items such as graphics. Image map is also similar to the hypertext menus, but selections are represented as a series of pictures. A further evolution of image map menu is to display an image depicting some place or thing (e.g., a picture of a bank branch with

25   tellers and loan officers).

A customized menu is a common method for allowing a user to navigate within an application is to list available functions or information by means of a menu bar with associated pull-down menus or context-sensitive pop-up menus. This method conserves screen real estate by hiding functions and options within menus; but, for this very reason, it

30   can be more difficult for first-time or infrequent users. This point is important when implementing electronic commerce solutions in which the target customer may use the application only once or very infrequently (e.g., pricing and purchasing auto insurance).

Also, browsers themselves can be programmed to support customized menus. This capability might be more applicable for intranet environments where the browsers need to be customized for specific business applications.

A virtual reality service or virtual environment interface takes the idea of a
5   graphical map to the next level by creating a three-dimensional environment for the user to "walk" around in. Popularized by such PC games as Doom, the virtual environment interface can be used for business applications. The consumer can walk through a shopping mall and into and around virtual stores or "fly" around a three-dimensional (3D) virtual version of a resort complex being considered for holiday.

10 To create sophisticated user navigation interfaces such as these requires additional architectural services and languages. The Virtual Reality Modeling Language (VRML) is one such language gaining in popularity on the Internet. Additionally, many tool kits and code libraries are available to speed development of virtual reality services. Those skilled in the art would recognize that as virtual reality services develop, they may be incorporated
15 into the presently disclosed invention.

The windows system services 56, which is typically part of the operating system used on the clients, provide the base functionality for creating and managing a graphical user interface on the workstations. As known in the art, a graphical user interface can detect user actions, manipulate windows on the display, and display information through
20 windows and graphical controls. Examples of windows system services 32 include Microsoft Windows, Windows 95/98 and Windows NT, Macintosh OS, Presentation Manager for OS/2, and X-Windows/Motif.

Window system services 56 expose their functionality to applications through a set of APIs. For the Microsoft windowing platforms, this API is called Win32, a documented
25 set of over 400 C functions that allow developers to access the functionality of the windowing system as well as various other operating system functions. Developers are able to call the Win32 API or its equivalent on other platforms directly, using a C language compiler; however, most development is done using higher-level development languages, such as Visual Basic or PowerBuilder, which make the lower level calls to the operating
30 system on behalf of the developer.

While the invention has been described in its currently best known modes of operation and embodiments, other modes and embodiments of the invention will be

apparent to those skilled in the art and are contemplated. For other features, advantages and combinations of the present invention refer to U.S. provisional application Serial No: 60/156,962, entitled NETCENTRIC AND CLIENT/SERVER COMPUTING which is herein incorporated by reference, in its entirety.

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